Fermilab

PPD/MD/Engineering Analysis Group

Summary of the Result for a Revised Mini 3-D Model

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10/21/2004

As discussed, a mini 3-D model has been modified slightly. It still has a symmetry boundary condition around **except one surface** as shown Figure 1. So, the structure will grow alone the beam direction only. Second, instead of "no glue at all", it is modified to have 30% area glued. The result for both tside=3 mm & trib=2 mm and tside=2 mm & trib=1.5 mm are available as following:

Table 1 The Summary of the Calculation Result
For t(side wall)=3 mm, t(rib)=2 mm

	Vertical and Horizontal extrusions Fully Glued	30% area glued
(1)Deflection (mils)	1.2 (Fig_1)	2.2 (Fig_4)
Max stress (psi)	502 (Fig_2)	1,128 (Fig_5)
Max shear in the mid plane (psi)	75 (Fig_3)	245 (Fig_6)

(1) The deflection stated in the summary's table 1 is the deflection at the outer edge of the horizontal extrusion. This deflection only reflects a half structure since the center line of the vertical extrusion is fixed as a symmetry. The structure grows at both direction (see Figure 1 for the model details).

Table 2 Result for t(side wall)=2 mm, t(rib)=1.5mm

	Vertical and Horizontal extrusions Fully Glued	30% area glued
[(1)]Deflection (mils)	2 (Fig_7)	4 (Fig_10)
Max stress (psi)	800 (Fig_8)	2,105 (Fig_11)
Max shear in the mid plane (psi)	104 (Fig_9)	361 (Fig_12)

Discussion

It seems that the structure is relatively stiff. For a pair of the vertical and horizontal extrusion, it grows about 2*1.1 mils=2.2 mils (50 micron) over 9 cm(2*4.5 cm) for a fully glued case. For a 100 m length, one might have about 1000 paired extrusions 100m/(2*0.045). It will result about 1000*2.2 mils=2.2 (inch) over 4,000" (or 5.6 cm over 100 m long). This "structure grow" under 21 psi could become a secondary factor where compared with the tolerance built-up or the uniformity of plastic extrusion which might have an even big number.

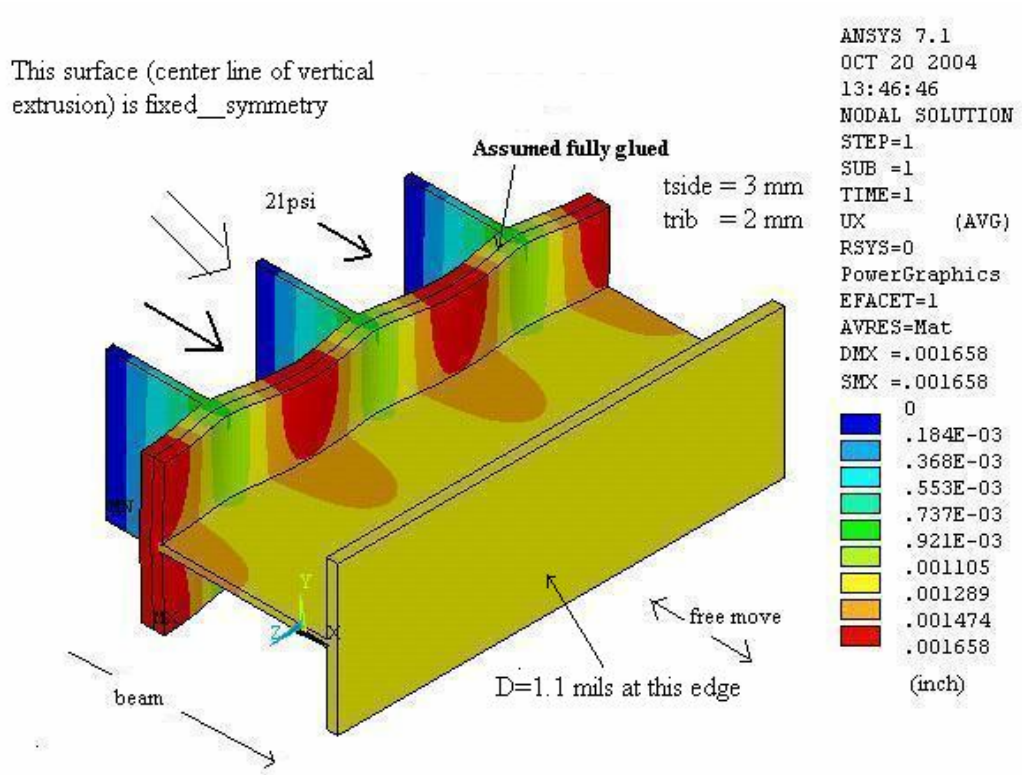

Figure 1 **Deflection along the beam direction for a fully glued case**

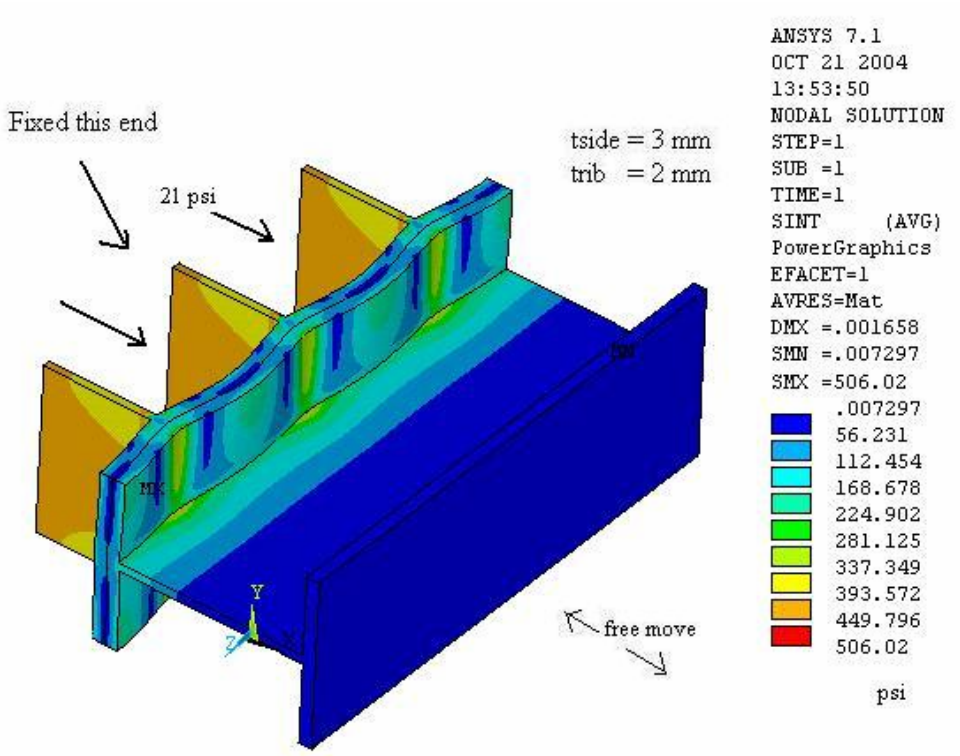

Figure 2 **Stress for a fully glued case**

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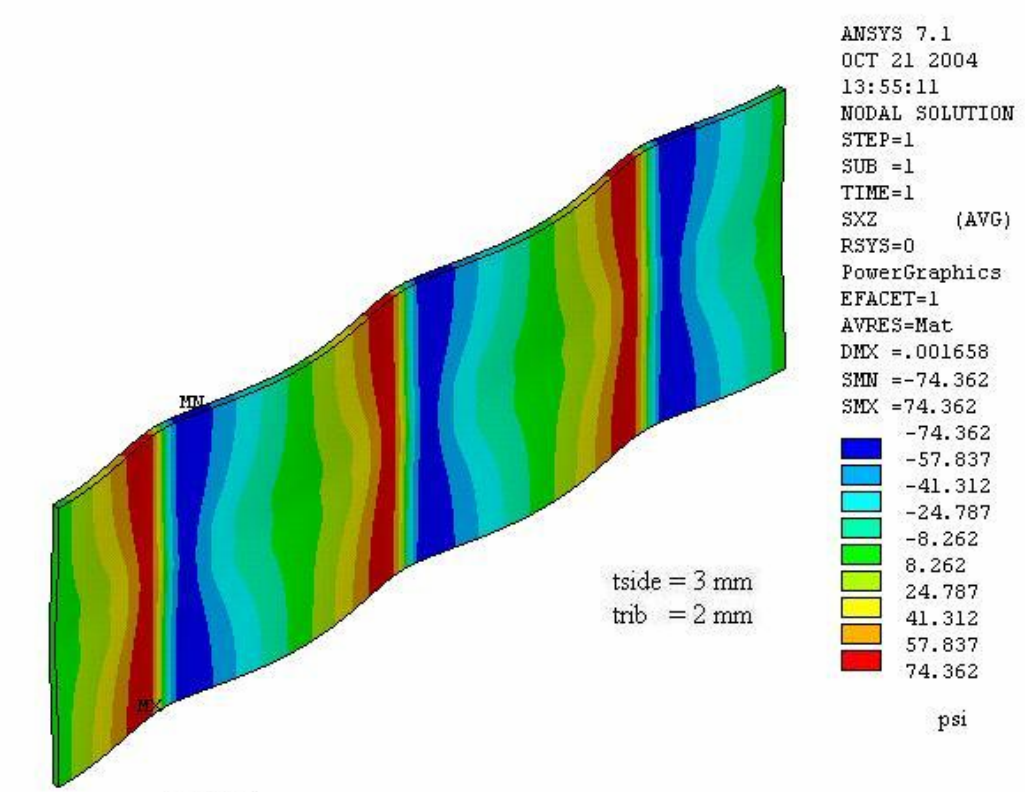
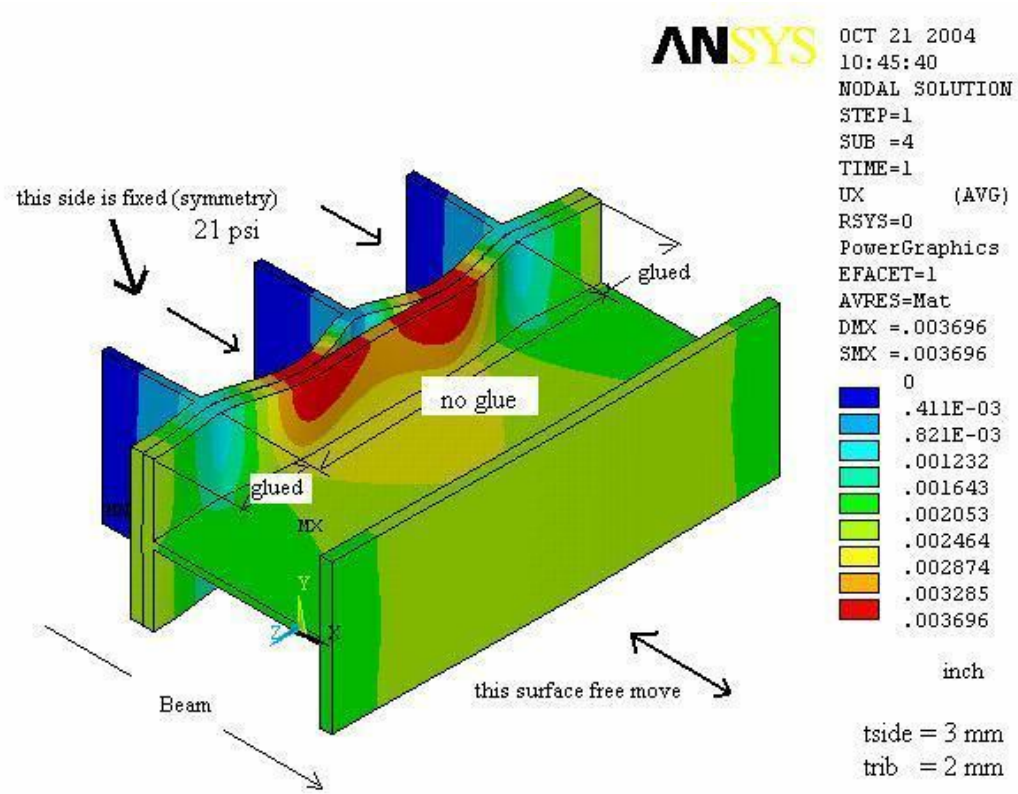


Figure 3 **Shear Stress in the mid plane for a fully glued case**



NOVA Figure 4 **Deflection along the beam direction for a partially glued case**

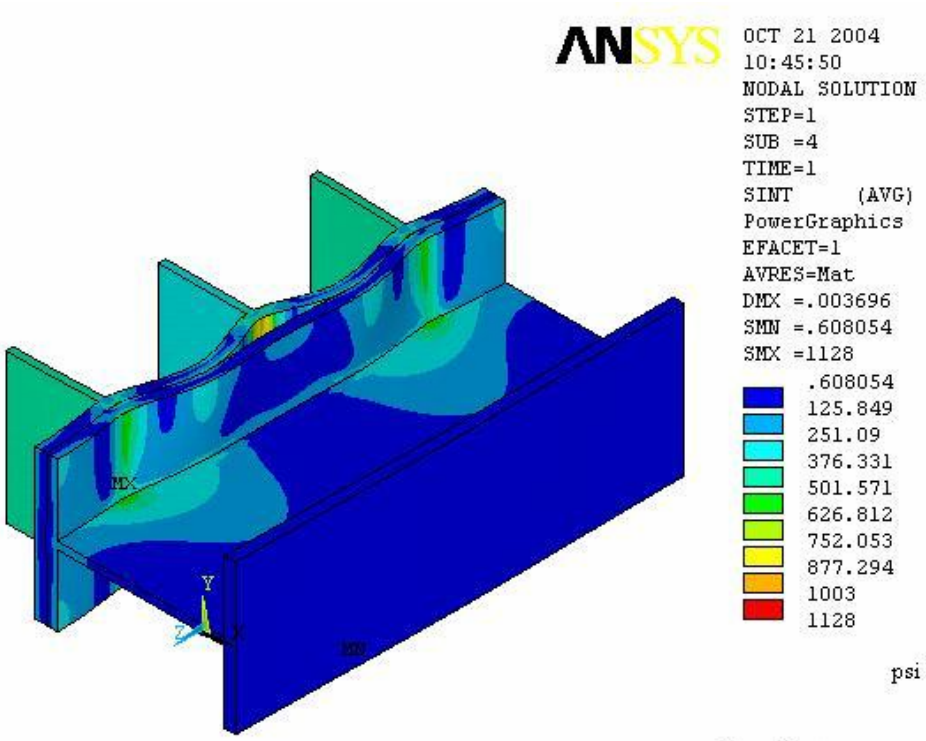


Figure 5 **Stress for a partially glued case**

tside = 3 mm
trib = 2 mm

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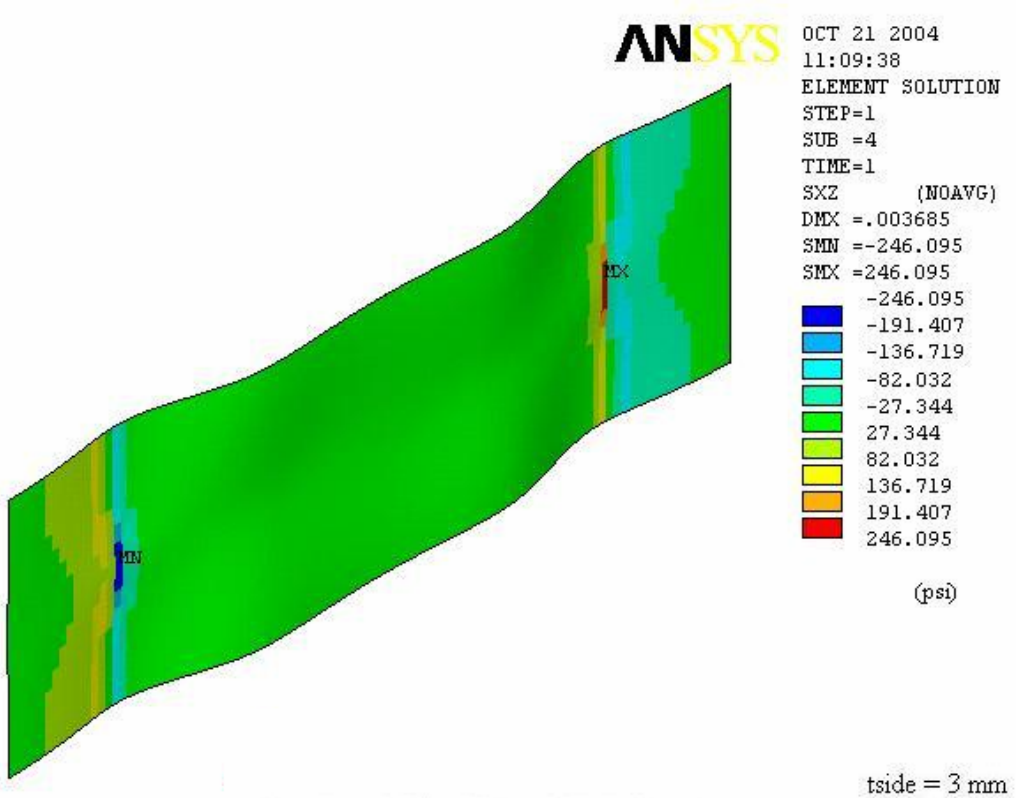

Figure 6 **Shear stress in the mid plane for a partially glued case**

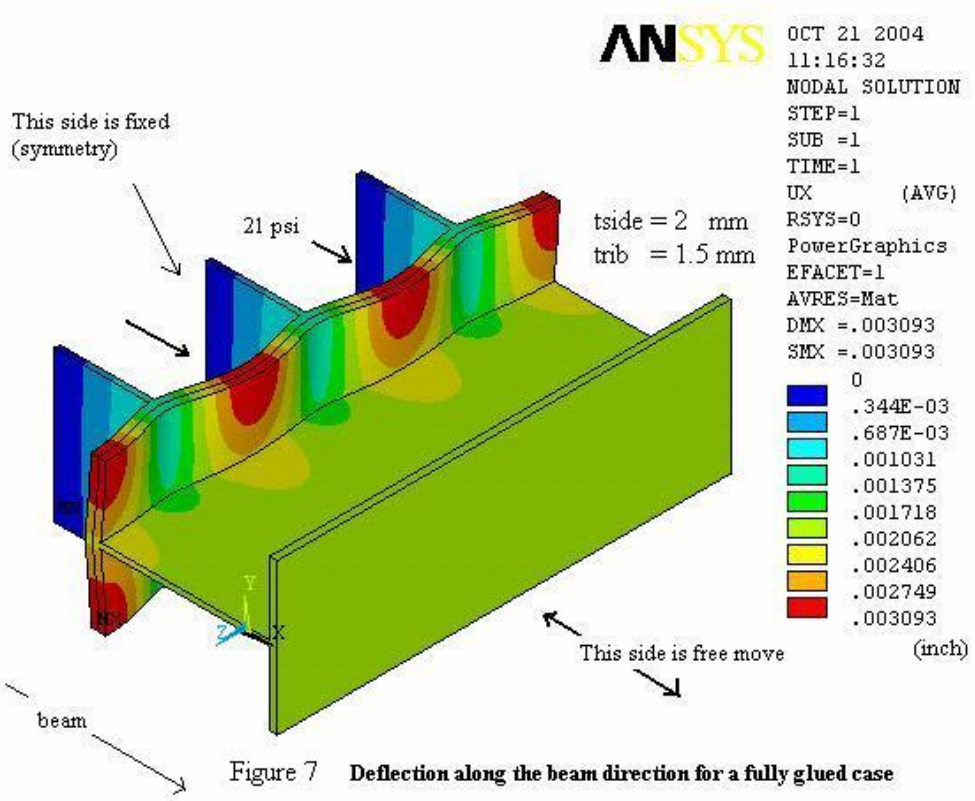

Figure 7 **Deflection along the beam direction for a fully glued case**

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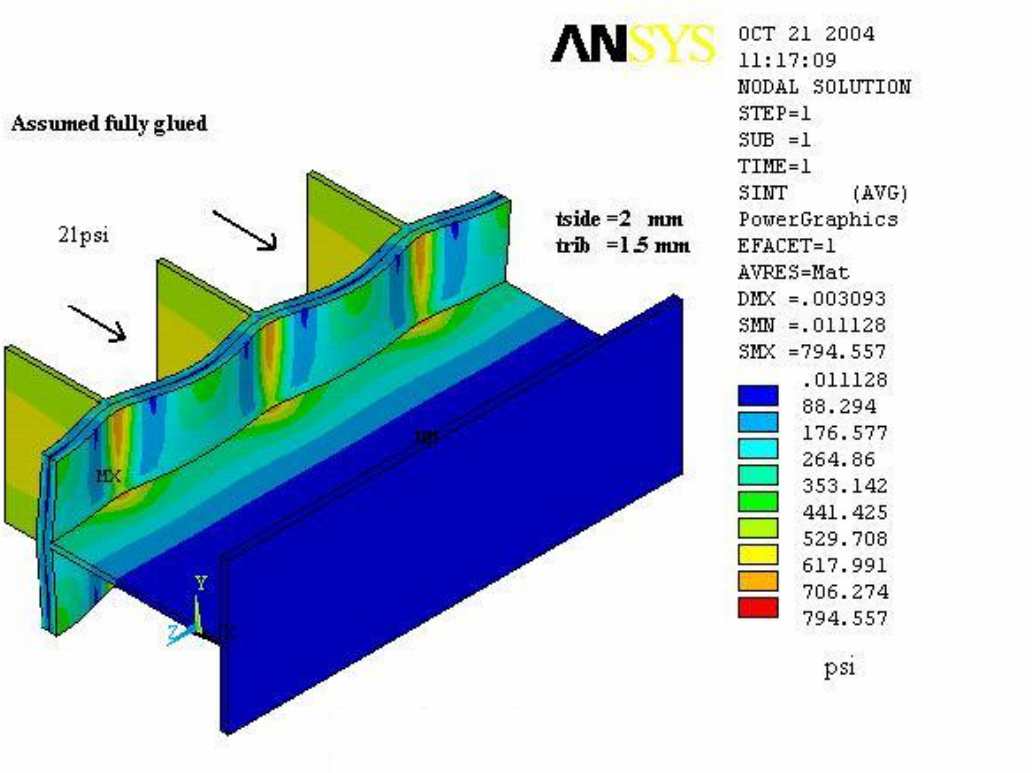

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Figure 8 **Stress for a fully glued case**

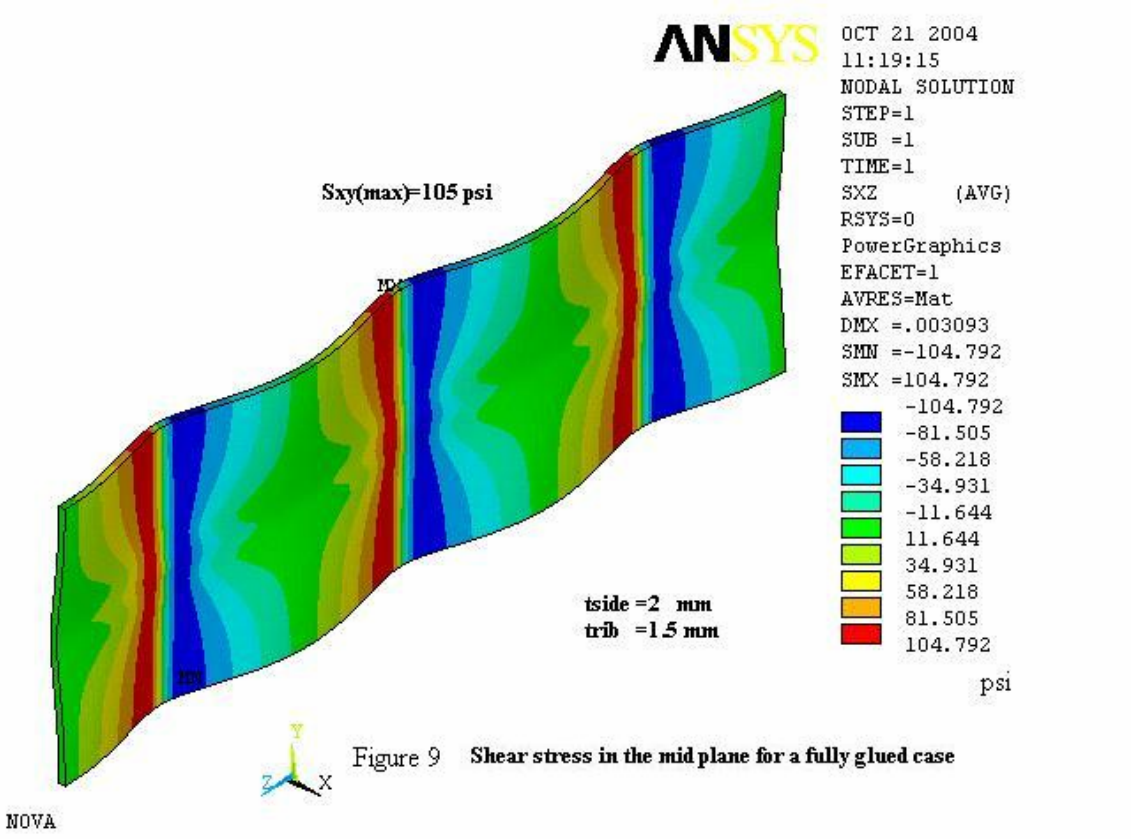
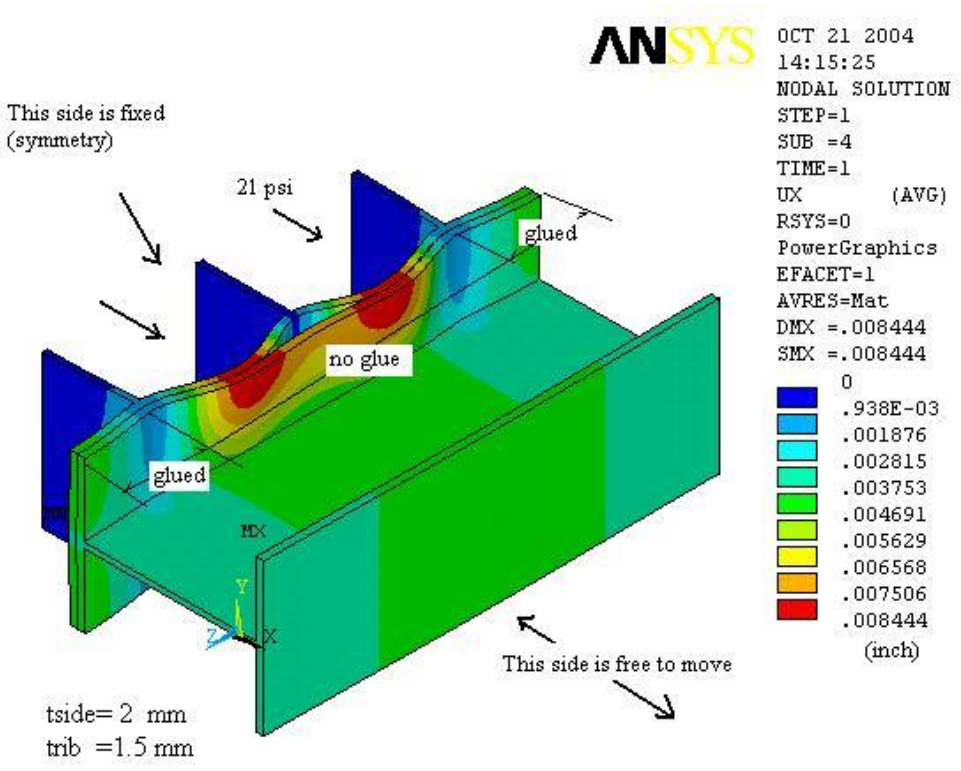


Figure 9 **Shear stress in the mid plane for a fully glued case**



NOVA Figure 10 **Deflection along the beam direction for a partially glued case**

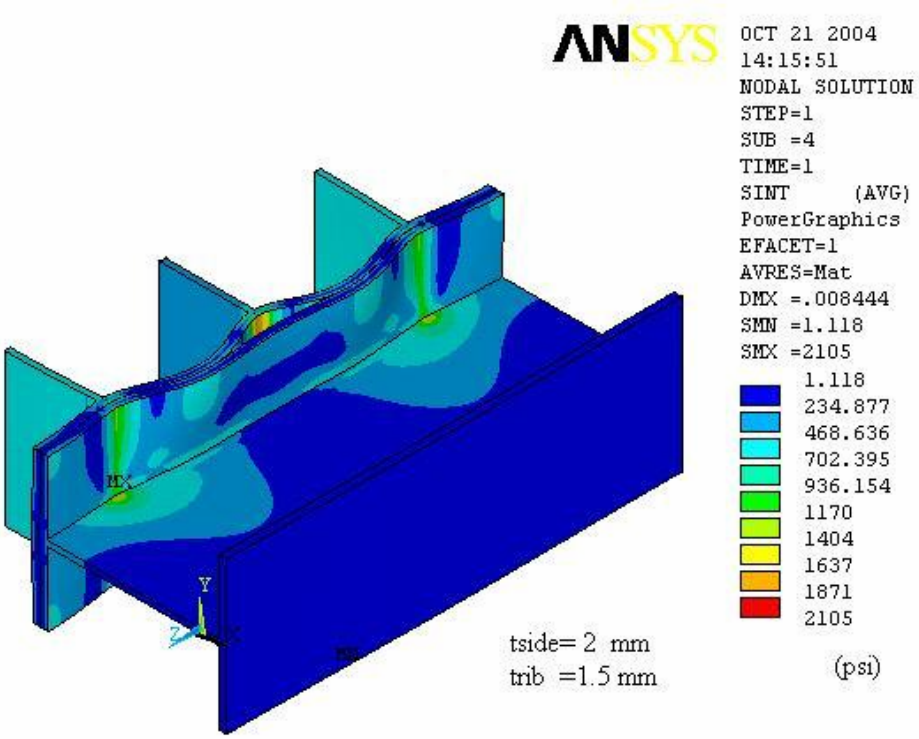


Figure 11 **Stress for a partially glued case**

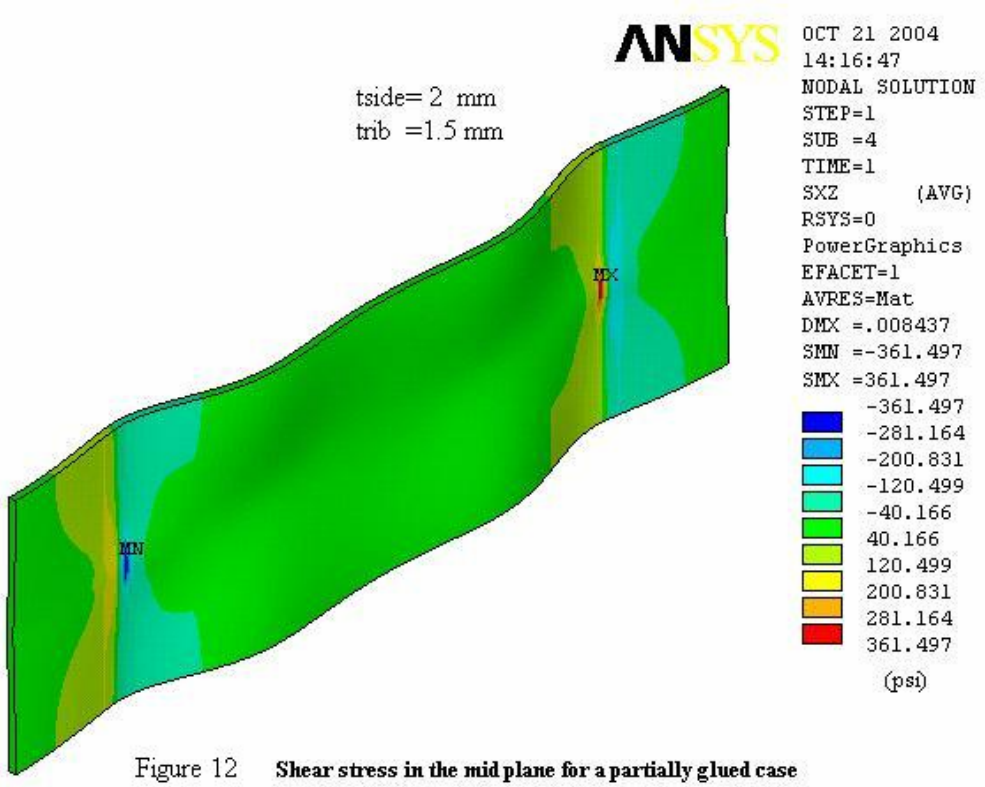


Figure 12 **Shear stress in the mid plane for a partially glued case**

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